

Space Weather Forecast

Issued on Thursday, 14 September 2023 at 13:13 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Daily Chance of Moderate-class X-ray flares and R1 Minor Radio Blackouts. Slight Chance of Minor Geomagnetic Storm G1 throughout, gradually falling with time.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity rose to Moderate in the last 24 hours, with a large, long-period Moderate-class X-ray flare from an energetic 'filament eruption' (arc of plasma leaving the Sun) in the northwest, close to the largest and most complex sunspot region on the facing side at present. This event has resulted in a Coronal Mass Ejection (CME), and although there is not yet sufficient imagery to analyse its trajectory, very provisionally, there is a chance of at least glancing incidence of Earth from such a location, probably this coming UTC weekend.

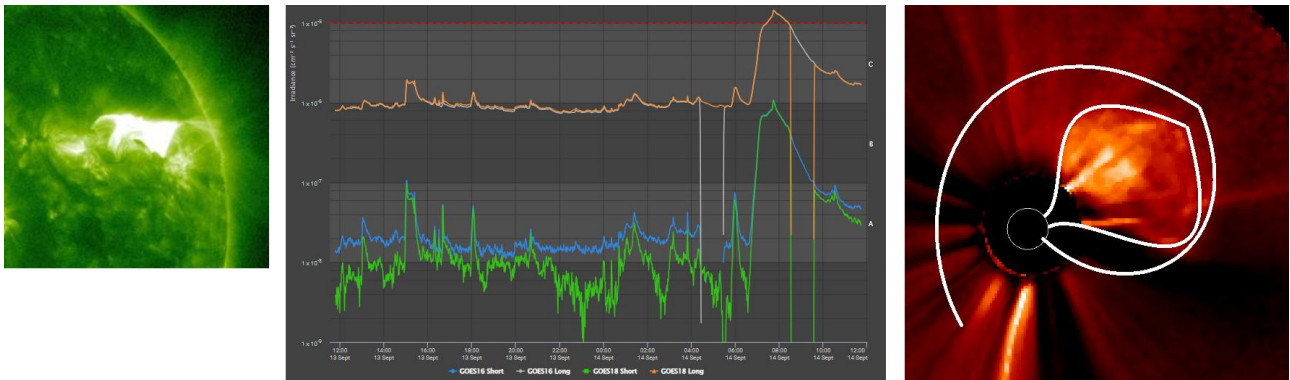


Figure 1: Left to right: False-colour extreme UV image of peak Moderate-class X-ray flare from a filament on the northwest of the Sun; Associated X-ray flare trace; Resulting 14/0930UTC early satellite image of the CME. The main ejecta can be seen to be heading north and west of the Sun-Earth line, but there does appear to be a partial halo component (shown as the outer white outline), which does intersect with the line from the Sun to the satellite (and Earth). This CME has yet to be analysed.

The above sunspot remained the largest and most complex of up to nine on the facing side at present, with its leading and central portions showing an overall slight areal decline in the period, while there are signs that its large trailing group is breaking up. The other main sunspot group that developed in the northeast showed notable proliferation of its intermediate spots, albeit with no related significant flare activity. The remaining other main bipolar regions showed more open centres and decay with time.

The CME tied to the aforementioned Moderate-class X-ray flare and filament eruption has not yet been analysed, however no other events of note were observed, and at the time of writing, no confirmed Earth-directed CMEs were observed during the past 24 hours.

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Solar Wind / Geomagnetic Activity: Solar wind parameters were perhaps indicative of a descent into a slow solar wind regime, but with a notable reversal starting around 14/0300UTC, likely a increase in many measures that sometimes appears in advance of fast streams of solar wind (a CIR - Co-rotating Interacting Region).

Solar wind speeds initially fell from slightly elevated levels into background values, before rising more sharply to an elevated high through the UTC morning. The number of particles comprising the solar wind was initially stable near its long-term average, but this rose to a peak by mid-morning before moderating slightly before the period's end. The associated magnetic field showed a gradual rise to become slightly elevated, falling back to earlier values in the final few hours. The north-south component of the solar wind magnetic field was variable, with much of the UTC evening spent in anti-aligned territory (versus Earth's field, often to greater geomagnetic effect).

The net effect of the above solar wind measures was for activity peaking just below Minor Geomagnetic Storm G1.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a daily Chance of Moderate-class flares, mainly from the largest and most complex sunspot group in the northwest, and perhaps now a second region nearing the middle of the Sun. The former should leave the Earth-facing side over the coming UTC weekend, but the flare risk may be maintained by the return of a large region in the east, which may be the source for some large recent far-sided CMEs and, by inference, large X-ray flares.

Solar Wind / Geomagnetic Activity: Two CMEs that left the Sun on 11 September may give glancing blows at Earth between days one to three (14 to 16 September), however, any potential effects at Earth are expected to be small if they do arrive. There is also one unassessed candidate - the filament-sourced CME noted above.

Coronal hole fast wind influence is expected to be imminent, beginning day one (Thursday 14 September), with speeds increasing to elevated levels initially, then perhaps to strong levels by later day two or day three (15 into 16 September) as a second coronal hole high speed stream takes over. Speeds may then begin to slowly ease to round-out the current forecast period.

Initially, a slight chance of G1/Minor Geomagnetic Storm intervals should gradually give way to a diminishing slight chance of similar G1s on subsequent days, with day four becoming quieter.

Energetic Particles / Solar Radiation: There is a daily slight chance of a solar radiation storm enhancement should any larger flares occur - from the complex sunspot on the northwest of the facing side of the Sun in particular.

Geomagnetic Storms:

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	20	10	10	5
Strong	G3	No	3	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	50	50	50	50
Very Active	R3 to R5 X	No	10	10	10	10

Solar Radiation Storms - (High Energy Protons):

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm⁻²sr⁻¹s⁻¹)